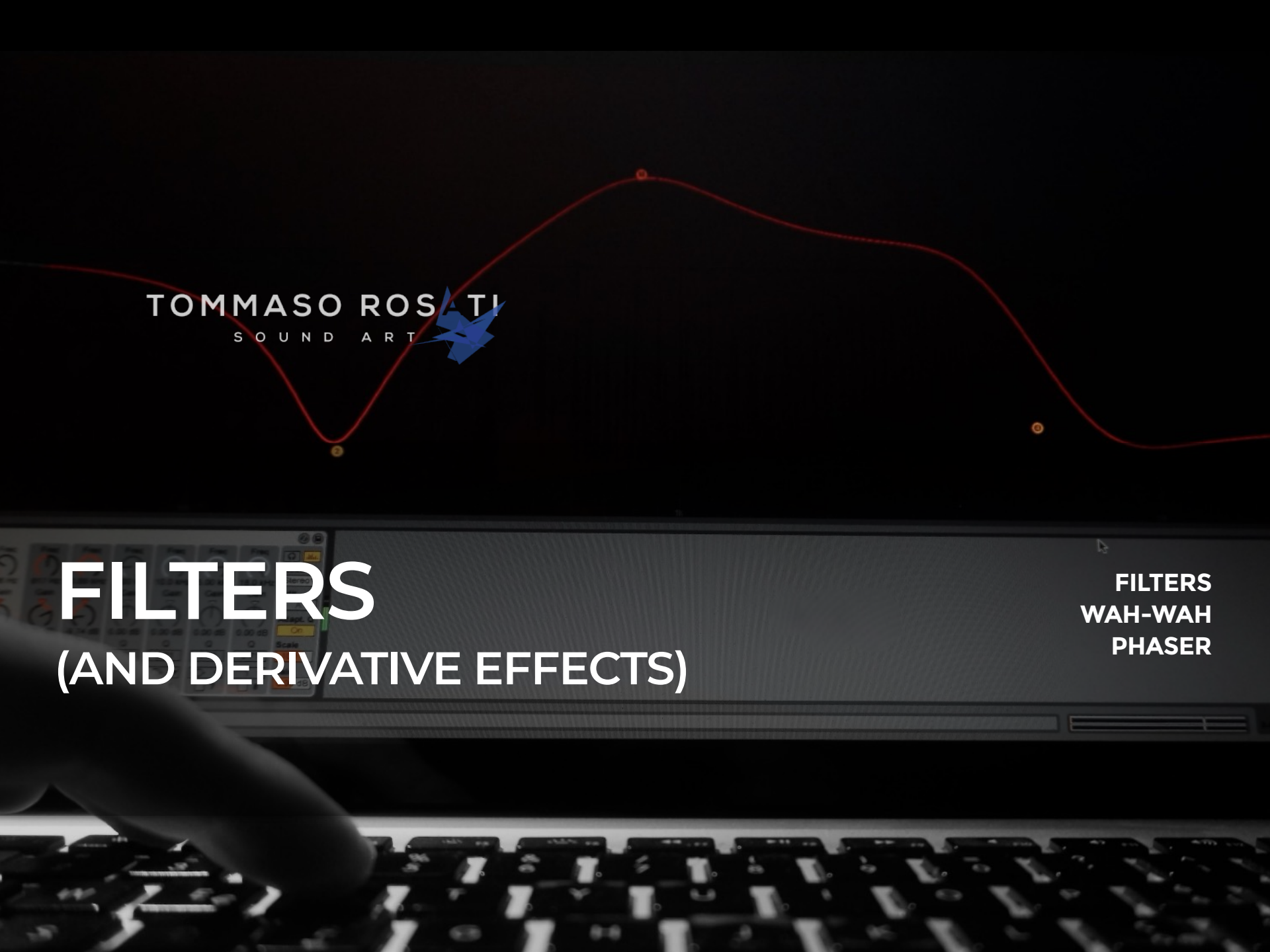
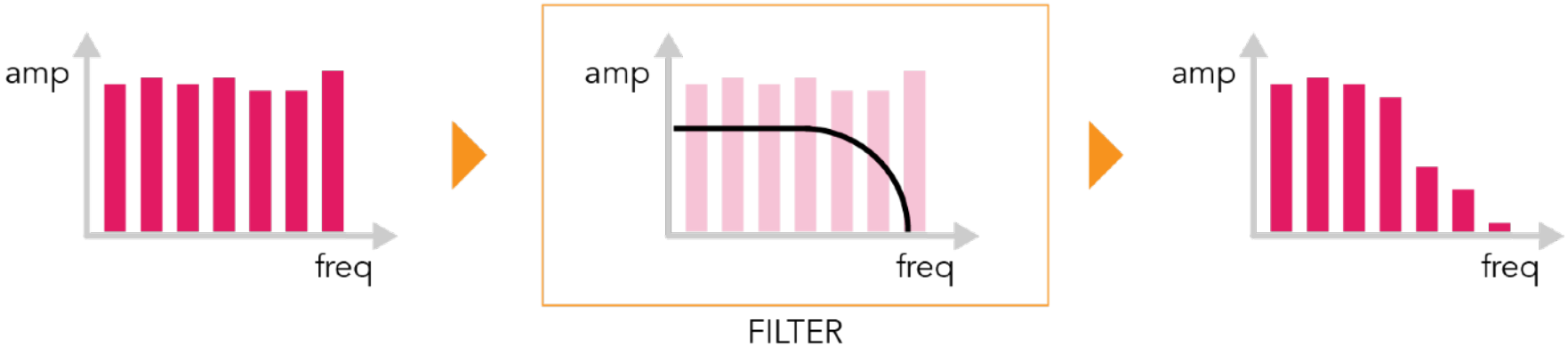


FILTERS
(AND DERIVATIVE EFFECTS)

FILTERS
WAH-WAH
PHASER

Filter

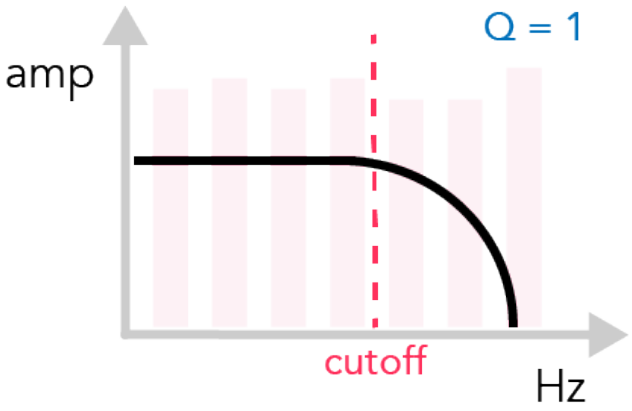
A **filter** is a device that attenuates the amplitude* of certain frequencies in a sound. With amplification and gain incorporated with filters, it is also possible to **emphasize** or boost certain frequencies. *.



* and, consequently, alters the phase

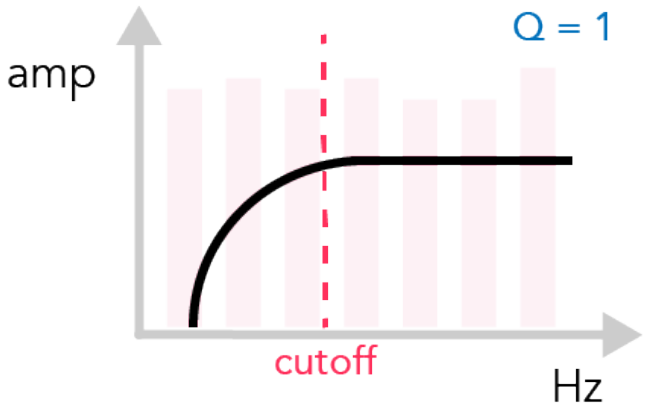
Main Filters

Low-Pass FILTER



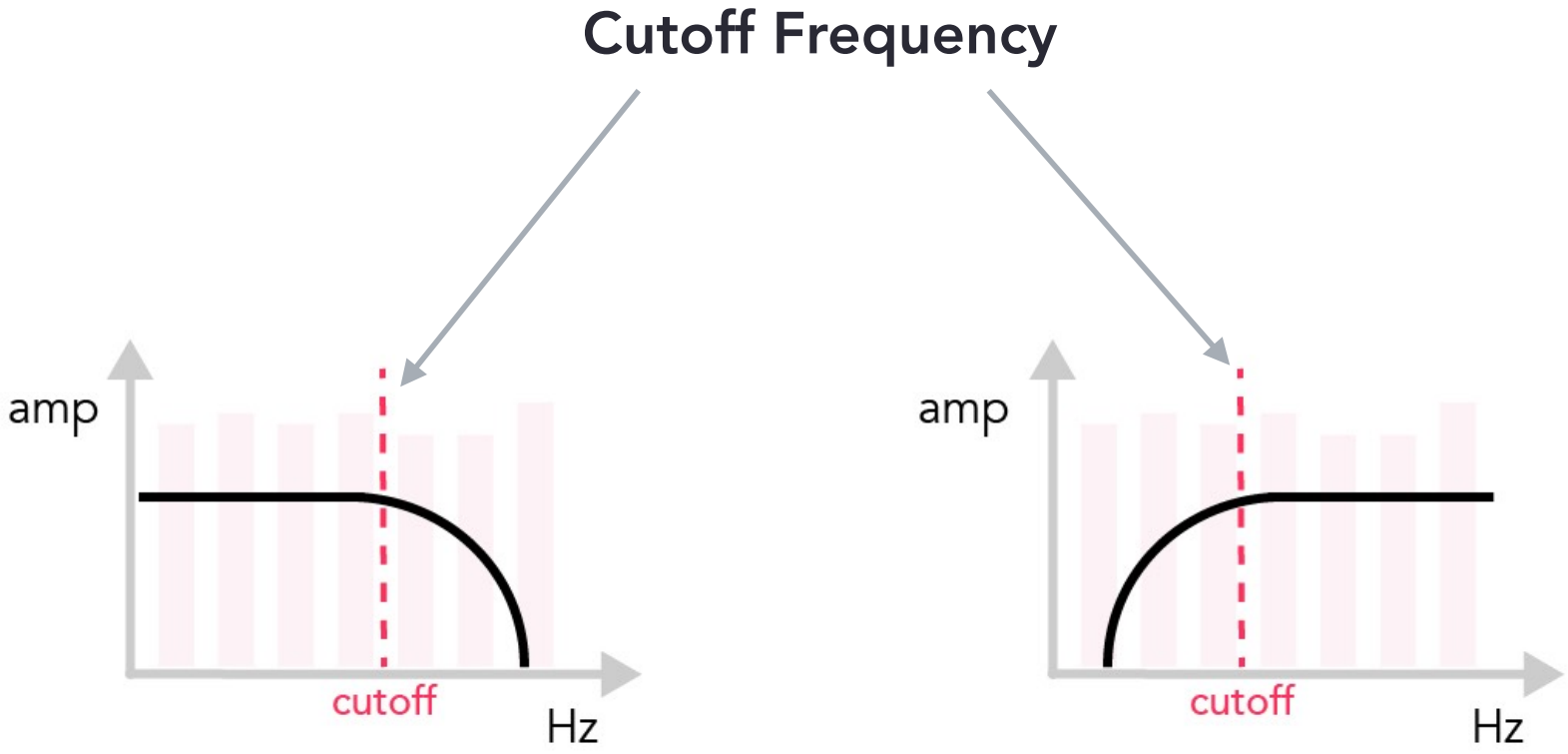
Cut off frequencies above the cut-off frequency while maintaining those below

High-Pass FILTER



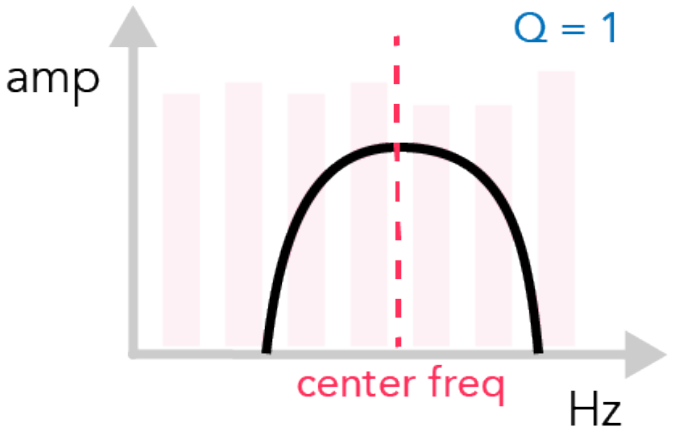
Cut off frequencies below the cut-off frequency while maintaining those above it

Parameters



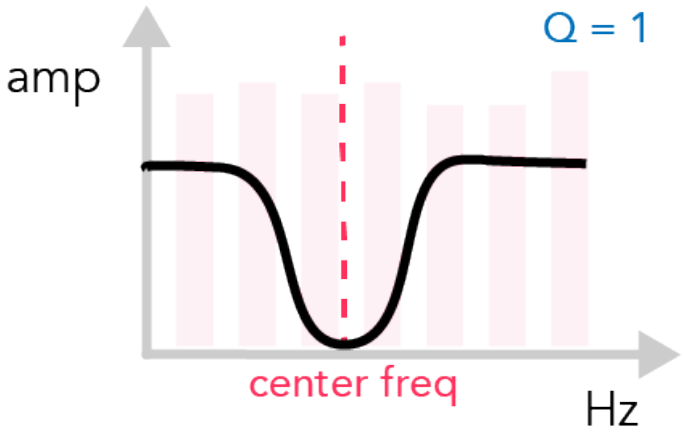
The frequency threshold, in Hertz, where the filter essentially activates

Band-Pass FILTER



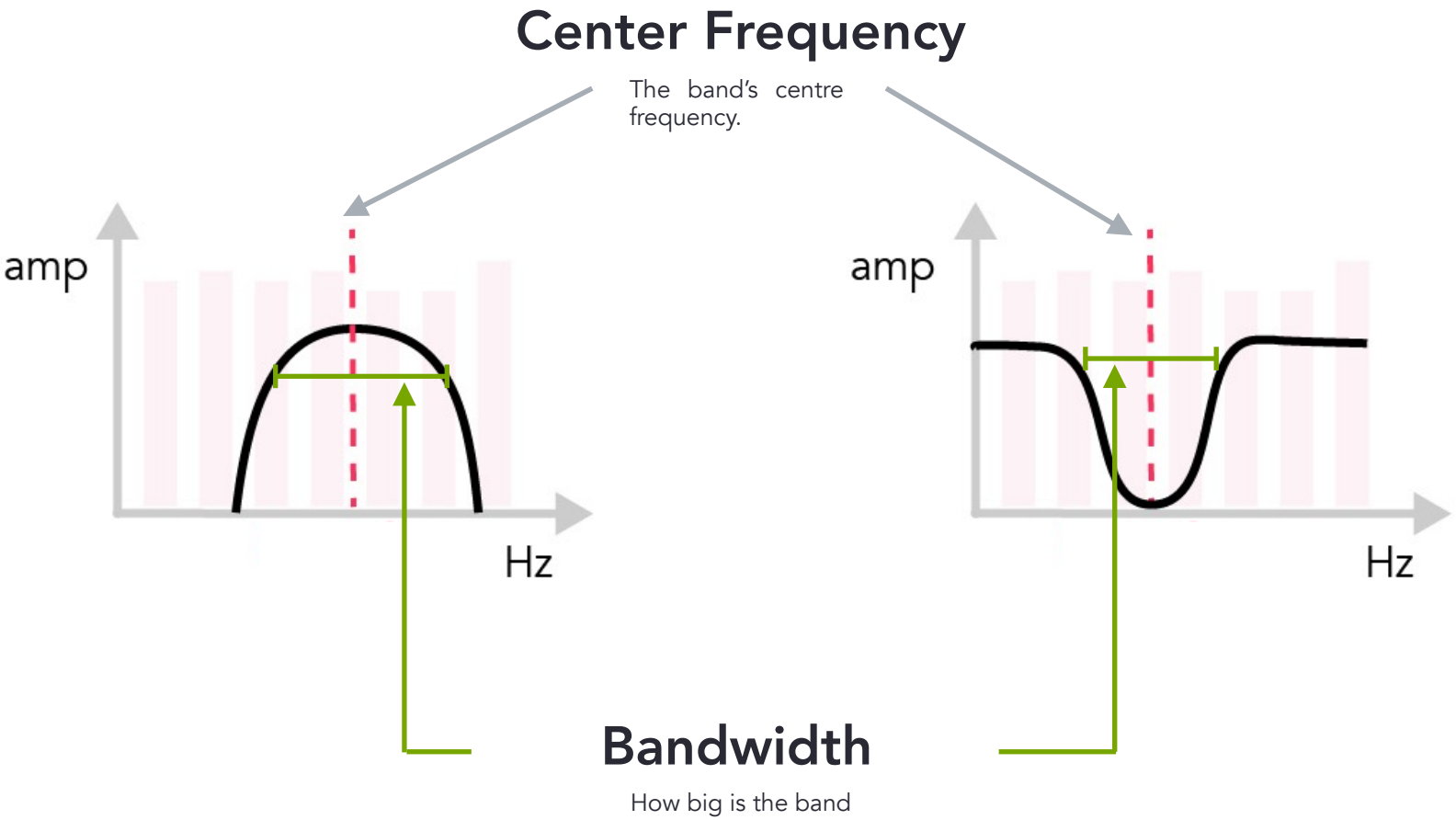
It passes frequencies within the frequency range of the chosen band.

Notch FILTER

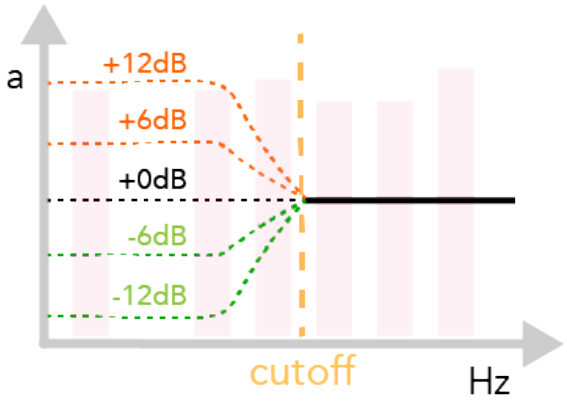


Removes frequencies within the frequency range of the chosen band.

Parameters

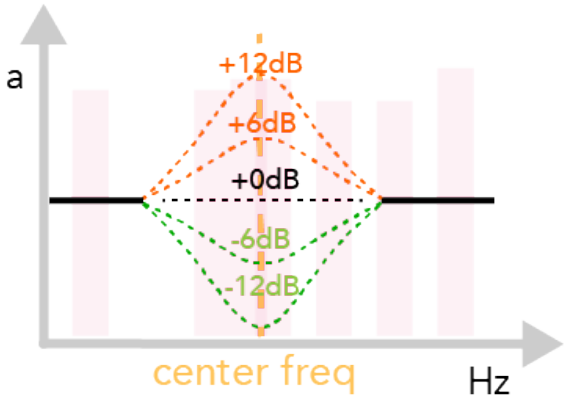

Center Frequency
The band's centre frequency.
amp
Hz
amp
Hz
Bandwidth
How big is the band

Low-Shelf FILTER



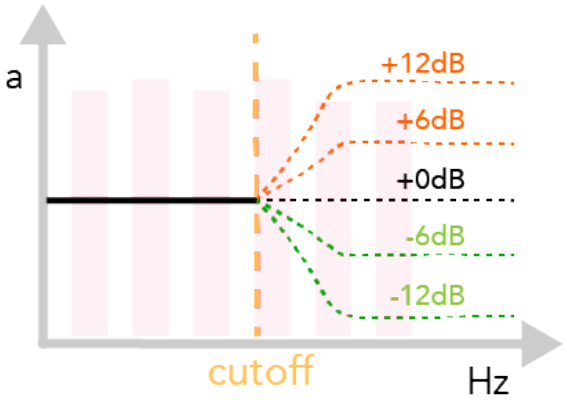
Emphasises or attenuates frequencies below the cut-off frequency

Bell FILTER



Emphasises or attenuates a frequency band

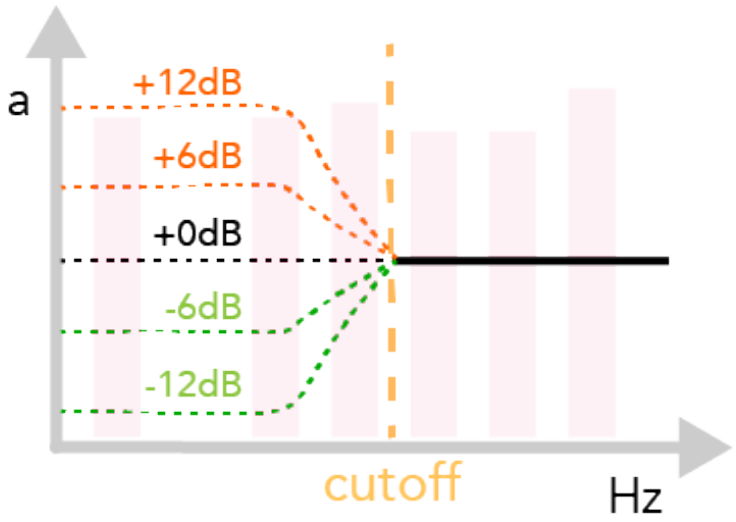
High-Shelf FILTER



Emphasises or attenuates frequencies above the cut-off frequency

Parameters

Gain

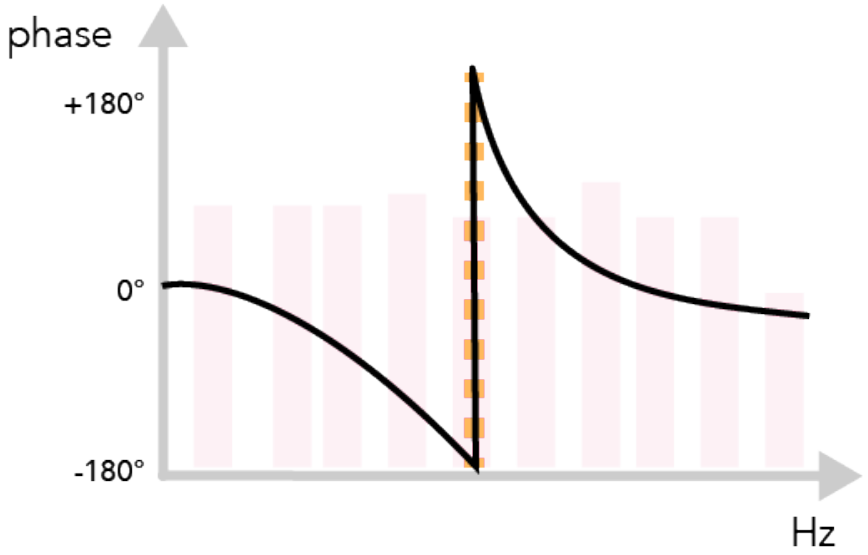


Indicates the increase or decrease in amplitude that the filter will apply to the incoming sound within its range of action. It is measured in dB.

All-Pass FILTER

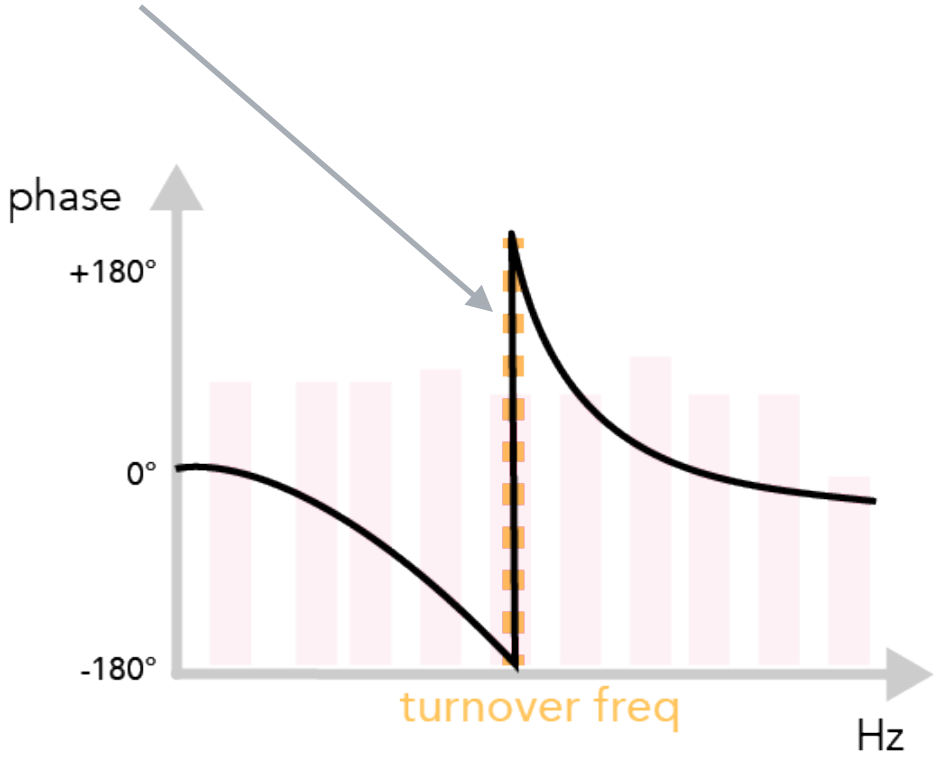
It makes all frequencies pass unchanged but changes the phases.

Adding the result of the all-pass filter to the original sound creates attenuations of frequency bands (filtering) near the turnover frequencies.



Parameters

Critical or Turnover frequency: the frequency at which the phases are inverted and thus when maximum filter action occurs



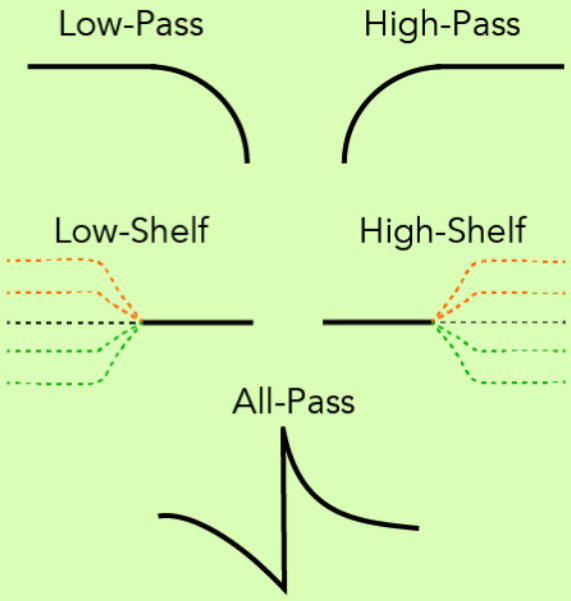
Parameters

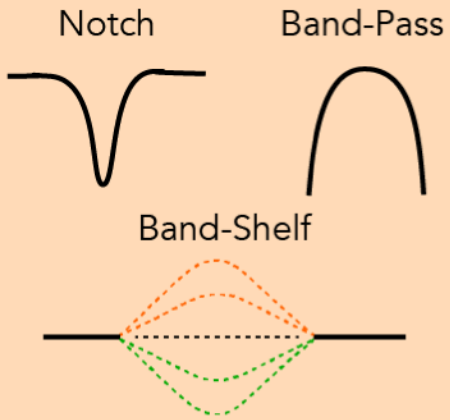
Resonance factor

(Q factor = Quality factor)

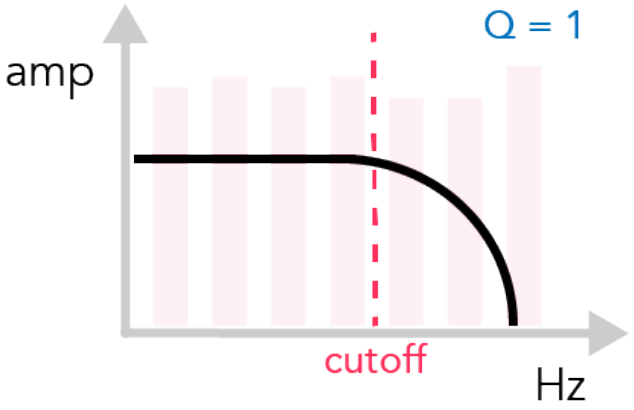
$$Q = \frac{1}{\text{damping}}$$
(dissipated energy)

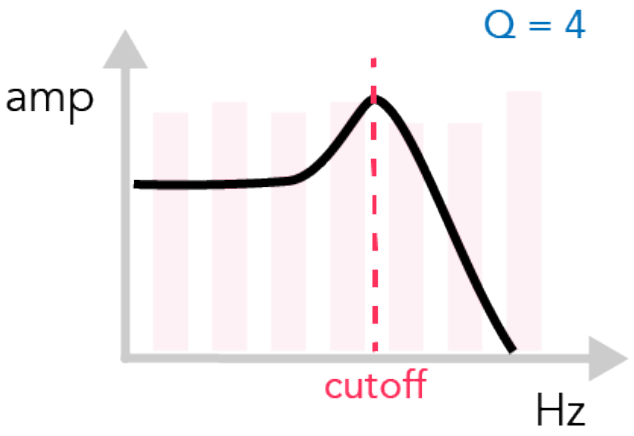
$$Q = \frac{\text{central freq.}}{\text{bandwidth}}$$



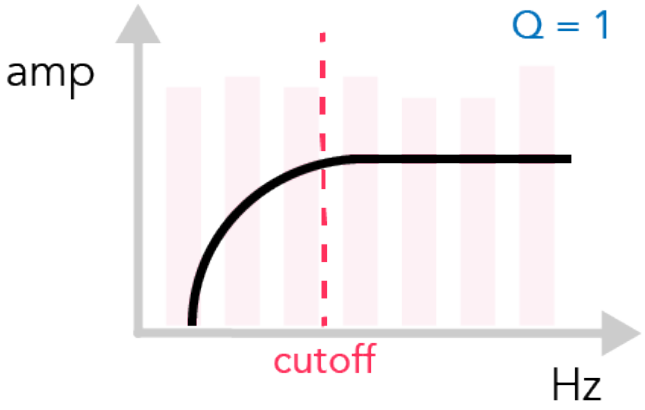


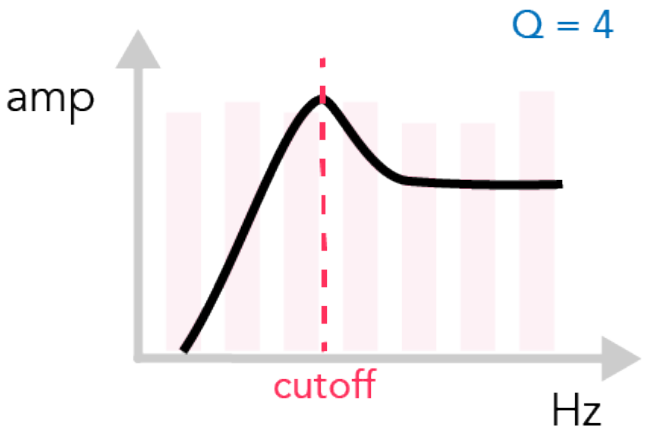
Low-Pass FILTER



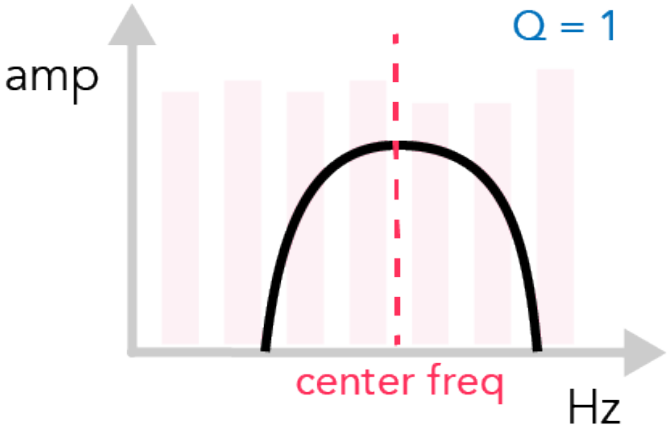


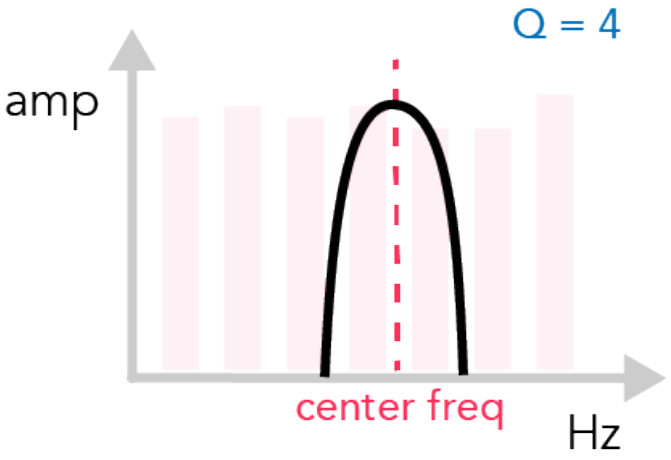
High-Pass FILTER



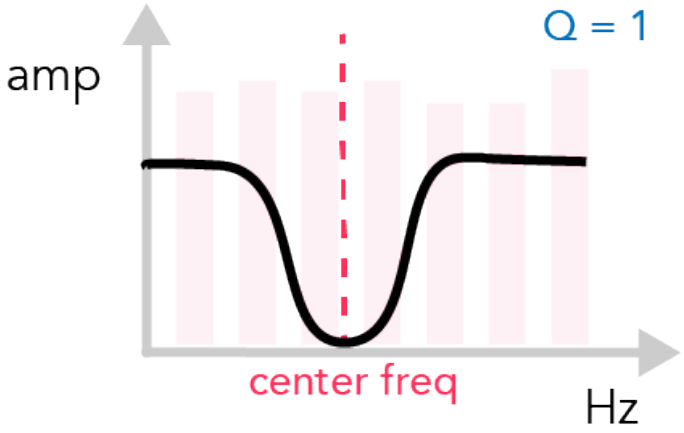


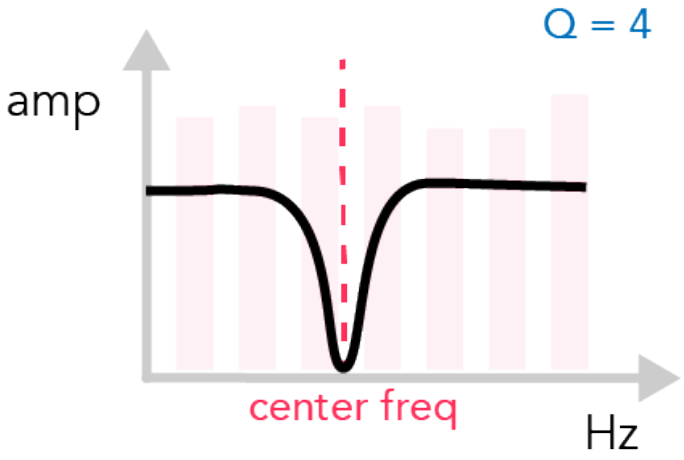
Band-Pass FILTER



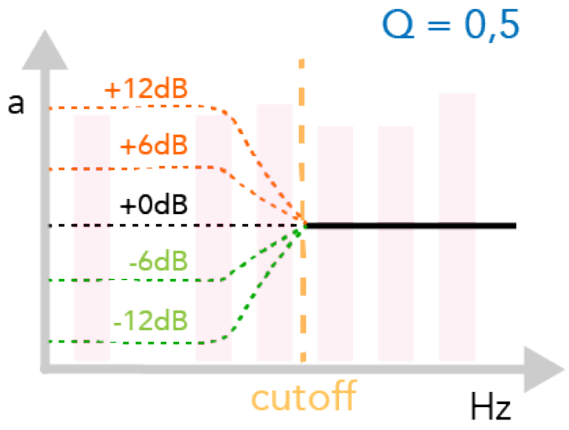


Notch FILTER

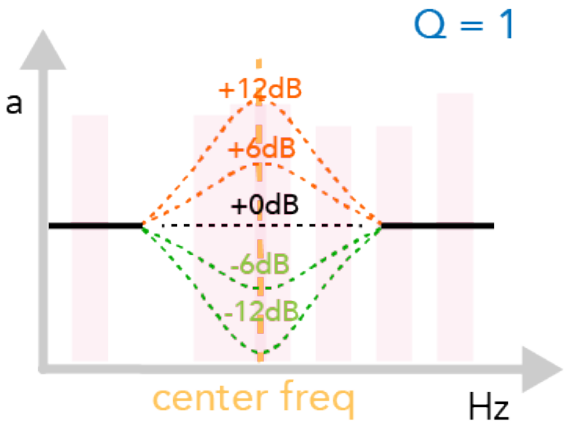




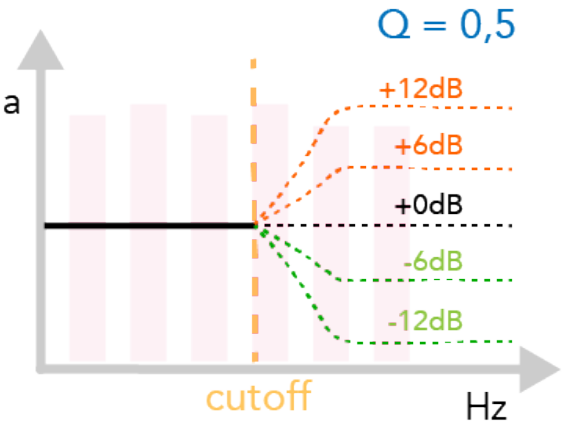
Low-Shelf FILTER

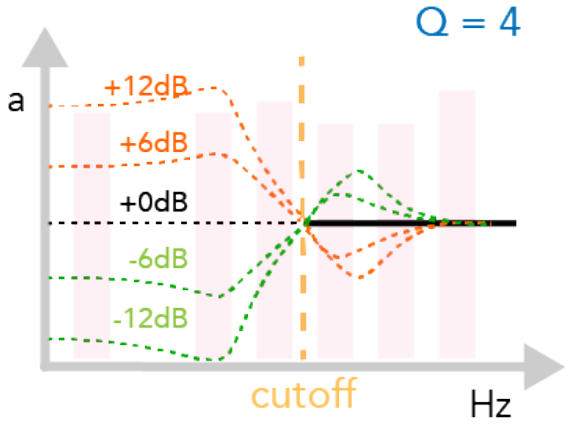


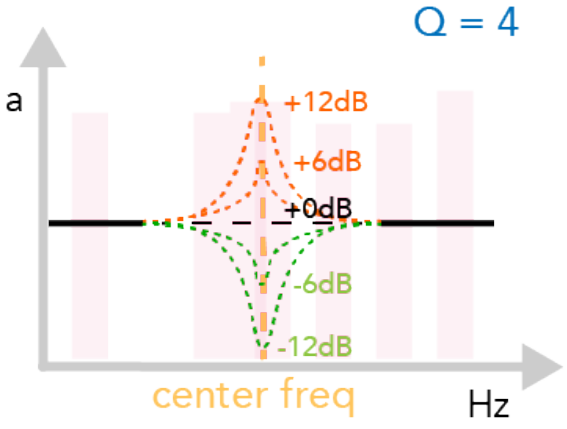
Bell FILTER

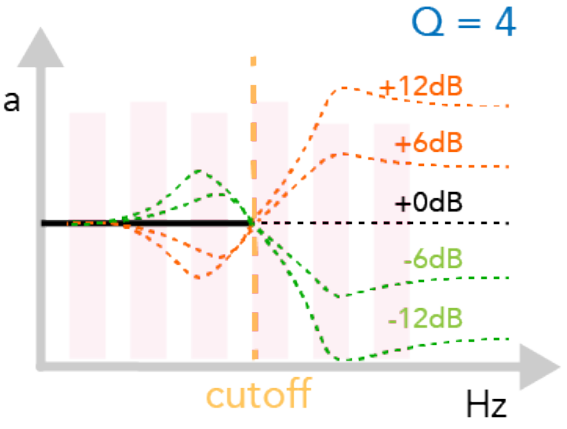


High-Shelf FILTER

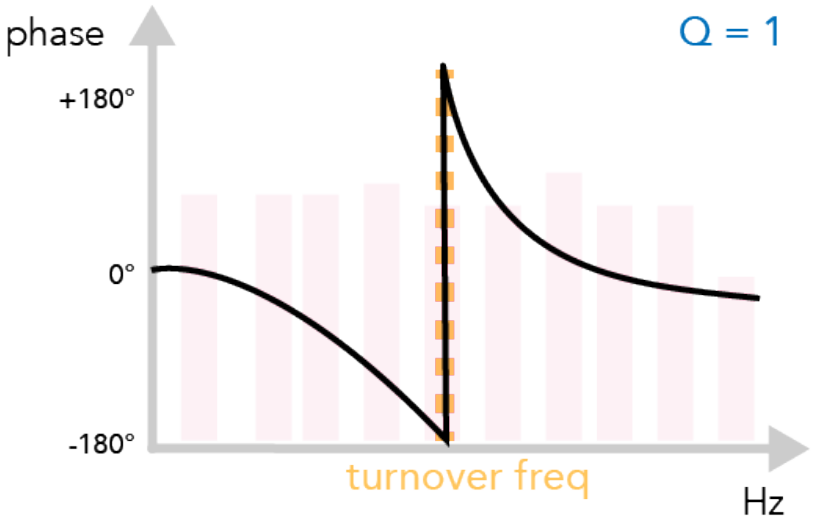


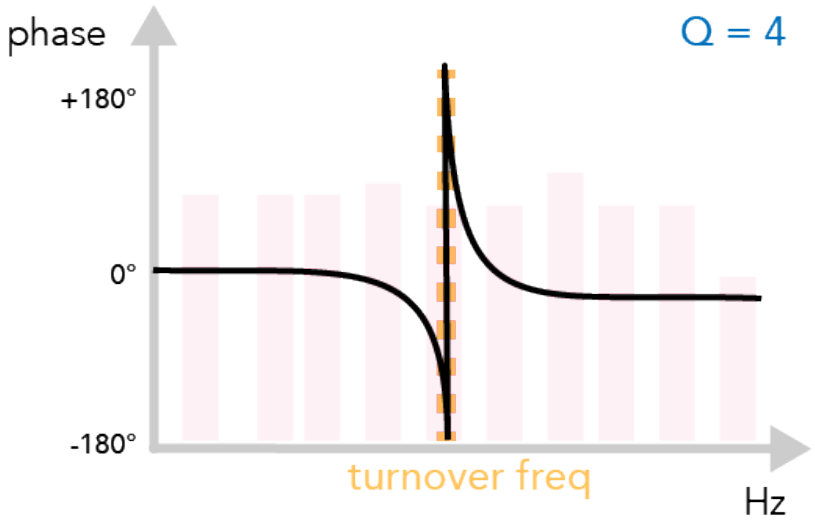






Q: in this case represents the slope of the phase curve and consequently the amplitude of the band subject to phase inversion, i.e. the band in which the filter has the greatest effect





Filters order:
How steep is the filter?

First order filters: attenuation of 6dB per Octave

1°

LPF example:
Cutoff: 1000 Hz
Input sound: sine wave 2000 Hz
Result: sine wave 2000 Hz halved in amplitude (-6 dB)

HPF example:
Cutoff: 1000 Hz
Input sound: sine wave 500 Hz
Result: sine wave 500 Hz halved in amplitude (-6 dB)

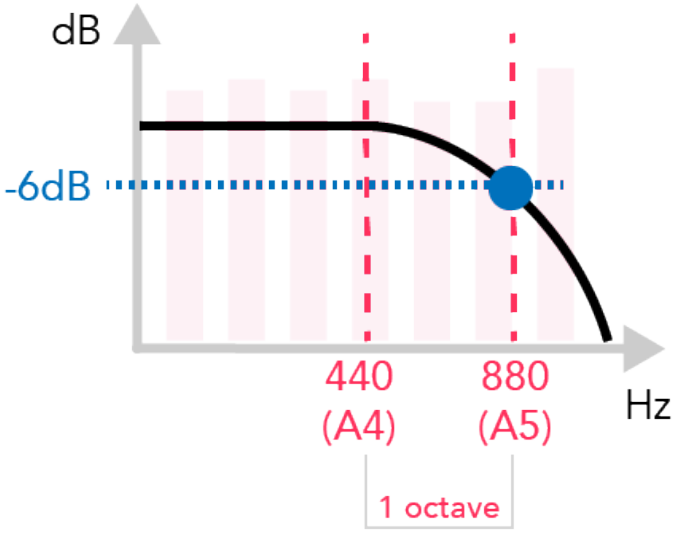
Second order filters: attenuation of 12dB per Octave

2°

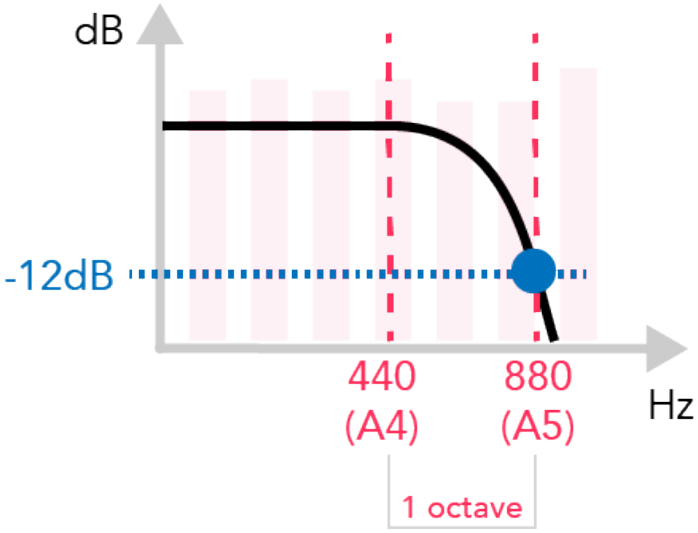
LPF example:
Cutoff: 1000 Hz
Input sound: sine wave 2000 Hz
Result: sine wave 2000 Hz at 1/4 of the amplitude (-12 dB)

HPF example:
Cutoff: 1000 Hz
Input sound: sine wave 500 Hz
Result: sine wave 500 Hz at 1/4 of the amplitude (-12 dB)

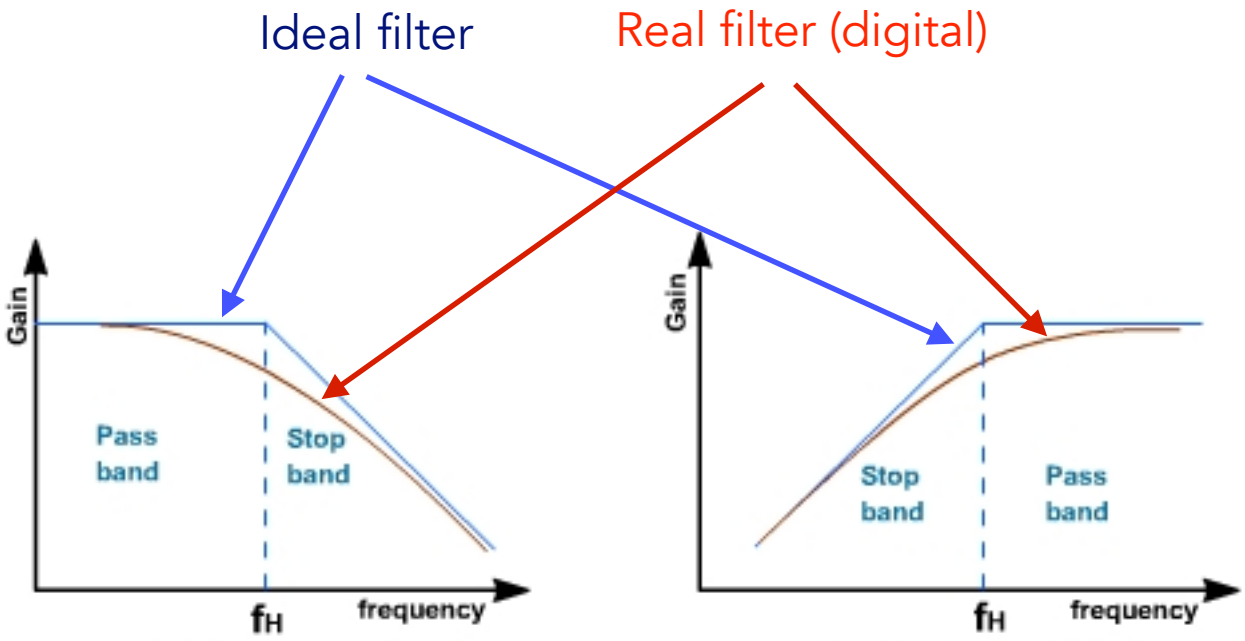
1st ORDER = 6dB per Octave



2nd ORDER =12dB per Octave

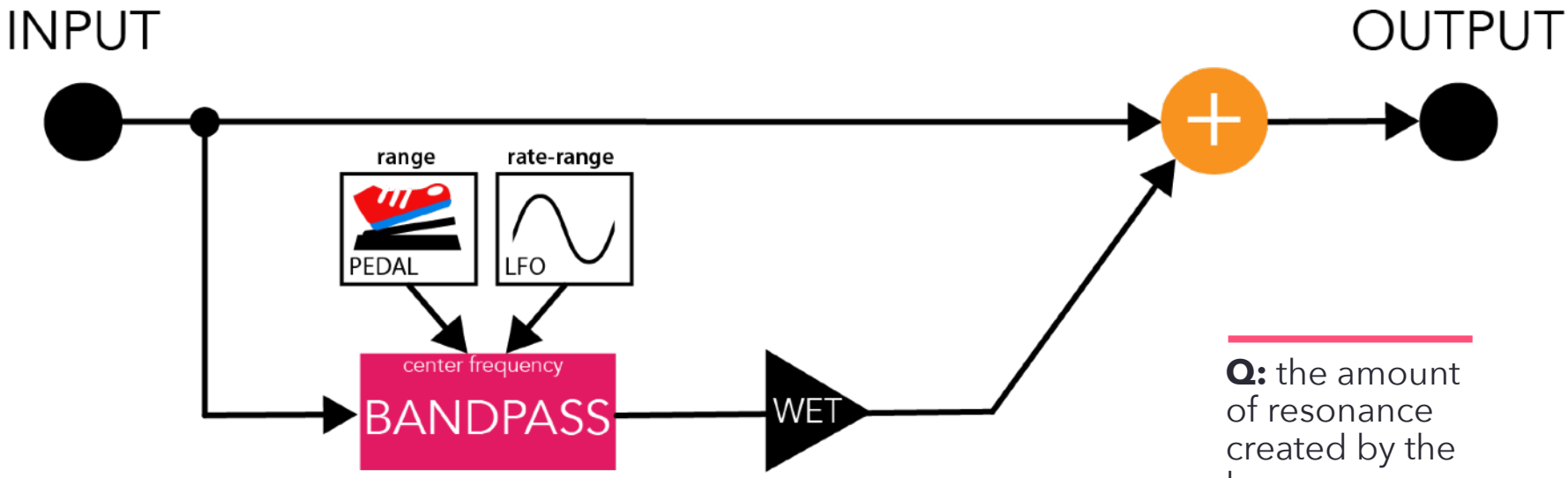


To obtain filters **higher than second-order** we connect in series several first or second-order filters.


Ideal filter
Real filter (digital)
Gain
Pass band
Stop band
fH
frequency
Gain
Stop band
Pass band
fH
frequency

Wah wah

If I rhythmically move the cutoff frequency of a band-pass filter or a low-pass resonant filter with a high Q value, I get an effect named after the sound result I get, a kind of 'mewing.' Usually, we use a dedicated pedal to modulate this effect, but you can also automate the shift with an LFO. In this case, it is called auto-wah.



Q: the amount of resonance created by the lowpass

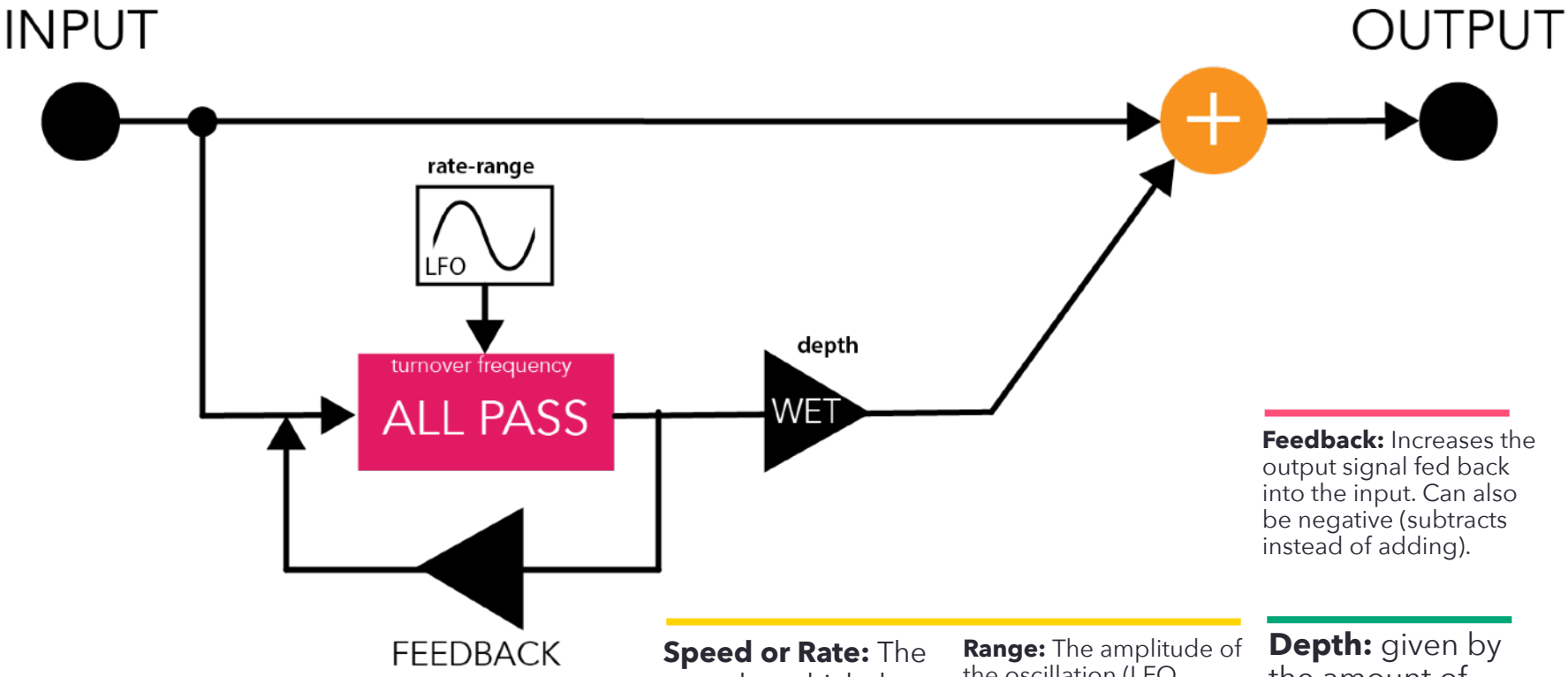
Speed or Rate: The speed at which the center frequency varies (LFO speed)

Range: The frequency range on which the pedal or LFO acts

WET: amount of processed sound that I add to the original

Phaser

It is achieved with an LFO that continuously changes the turnover frequencies of all-pass filters.
It causes attenuation of frequency bands due to phase changes of the input signal and subsequent summation of the processed signal with the original one.



Feedback: Increases the output signal fed back into the input. Can also be negative (subtracts instead of adding).

Speed or Rate: The speed at which the turnover frequency varies (LFO speed)

Range: The amplitude of the oscillation (LFO amplitude) that controls the range of variation of the turnover frequency

Depth: given by the amount of delayed sound I add to the original

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